

Patent Claims:

1. Method for determining the rotor position of a stationary or slowly rotating synchronous machine by evaluating electrical test pulses that are obtained by applying voltage pulses to the individual phase windings of the stator, wherein changes in the inductance of the phase windings which are caused by saturation of the stator iron depending on the rotor position, are determined in opposite directions of current by calculating differences in the amount of current of two test pulses, and angle values being predetermined by the number of the phase windings are associated with the differences in the amount of current,

c h a r a c t e r i z e d in that prior to the first test pulse  $I_{\text{meas1}}$ , a bias pulse  $I_{\text{bias}}$  whose polarity is inverted in relation to the first pulse  $I_{\text{meas1}}$  is generated, with the switch-on times  $t_1$  of the associated voltage pulses  $U_{\text{bias}}$  and  $-U_{\text{meas1}}$  being equal, and in that the respectively first test pulse  $I_{\text{meas1}}$  generated in the corresponding phase winding (U, V, W) acts as a bias pulse in the same phase winding (U, V, W).

2. Method as claimed in claim 1,  
c h a r a c t e r i z e d in that defined angle offset values are added to angle values being associated with the differences in the amount of current  $\Delta I$  when the test pulses  $I_{\text{meas}}$  are evaluated, and the so produced pairs of values are compared with a

reference characteristic curve, and the sum of the squares of the comparison results is produced and stored together with the associated angle offset value in a memory, whereupon the minimum of the sum is determined and the associated angle offset value  $\phi_{\text{start}}$  is issued as the measured rotor position.

3. Method as claimed in claim 2,  
c h a r a c t e r i z e d in that the angle offset values are limited to an angular range being defined by the evaluation of the signs of the established differences in the amount of current.
4. Method as claimed in claim 2 or 3,  
c h a r a c t e r i z e d in that several cycles of evaluation are performed consecutively with decreasing distances between the angle values.
5. Method as claimed in any one of claims 1 to 4,  
c h a r a c t e r i z e d in that one or more compensation pulses  $U_{\text{comp}}$  are generated in order to increase the current decline gradient of the biasing pulse  $I_{\text{bias}}$  and the test pulses  $I_{\text{meas}}$ .
6. Method as claimed in any one of claims 1 to 5,  
c h a r a c t e r i z e d in that two or more phase windings are connected with defined potentials for a fixed time  $t_1$  in order to generate a test pulse  $I_{\text{meas}}$ .
7. Method as claimed in any one of claims 1 to 5,  
c h a r a c t e r i z e d in that in order to generate a test pulse  $I_{\text{meas}}$  in motors having a star

connection, one or more phase windings and the star point are connected with defined potentials for a fixed time  $t_1$ .

8. Method as claimed in claim 6 or 7,  
c h a r a c t e r i z e d in that the fixed time  $t_1$  is chosen depending on the voltage  $U_{\text{meas}}$  necessary to produce the test pulses  $I_{\text{meas}}$  and applied to the phase windings.
9. Method as claimed in claim 8,  
c h a r a c t e r i z e d in that the fixed time  $t_1$  is chosen depending on the temperature of the synchronous machine 1.
10. Method as claimed in any one of claims 6 to 9,  
c h a r a c t e r i z e d in that the fixed time  $t_1$  is gradually extended until a desired current amplitude of the test pulse  $I_{\text{meas}}$  is reached.
11. Method as claimed in any one of claims 1 to 10,  
c h a r a c t e r i z e d in that the current amplitude of all test pulses  $I_{\text{meas}}$  is determined using one single means of measurement.
12. Method as claimed in any one of claims 1 to 10,  
c h a r a c t e r i z e d in that a current measuring device serving to determine the current amplitude of all test pulses  $I_{\text{meas}}$  is associated with the synchronous machine (1).

13. Method as claimed in any one of claims 5 to 12,  
c h a r a c t e r i z e d in that the change in the  
rotor position due to the moment reaction of the test  
pulses  $I_{meas}$  is measured, and the angle values  
associated with the differences of the amount of  
current are corrected depending on the measurement.
14. Method as claimed in any one of claims 2 to 13,  
c h a r a c t e r i z e d in that the reference  
characteristic curve is adapted to the detected  
differences of the amount of current.
15. Method as claimed in any one of claims 1 to 14,  
c h a r a c t e r i z e d in that the voltage applied  
to the phase windings is monitored during the switch-on  
time  $t_1$  of the voltage pulses  $U_{meas}$ , and the test pulse  
 $I_{meas}$  is repeated in the event of a deviation from a  
predetermined tolerance.
16. Method as claimed in any one of claims 1 to 15,  
c h a r a c t e r i z e d in that the current  
amplitude  $I_{meas}$  of the voltage pulses  $U_{meas}$  is monitored  
during their switch-on time  $t_1$ , and that the test pulse  
 $I_{meas}$  is repeated in the event of a deviation from a  
predetermined tolerance.
17. Method as claimed in any one of claims 2 to 16,  
c h a r a c t e r i z e d in that the minimum of the  
sum of the squares of the comparison results is used as  
a criterion of the quality of the determination of the  
rotor position.